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The Factors Affecting Nepal's Trade: Gravity Model Analysis

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Abstract:

This paper examines the influence of trade gravity variables on bilateral trade of Nepal. The panel data estimation technique and gravity model are used to analyze Nepal's trade with its 26 major trading partner countries for the period of 1990 to 2016. The estimated results reveal that the income of the countries, exchange rate and the distance between the countries has a significant impact on trade pattern of Nepal with its trading partners. The empirical results are found consistent with the fundamentals of gravity model. The paper suggests that the trade policy should not ignore the importance of the level of development. The results also suggest that trade with India in comparison to China and other countries are quite substantial. The results suggest that Nepal needs trade diversification in general and trade agreement with China, Japan in particular to reap the benefits from the trade.

Key words: Gravity Model, Panel Data, Nepal's Trade, GDP, Exchange Rates

1. INTRODUCTION

Today, trade is globally recognized as an engine of growth and development. But trade depends on a range of factors that could change in the future and affect not only the extent but also the nature and impact of trade. It is therefore extremely necessary to be well aware of the factors that could influence trade. Nepal initiated its economic liberalization program in the mid-1980s; this included deregulation of the financial sector, trade liberalization, current account convertibility, the abolition of major trade restrictions, several privatization programs and policies, revision of the trade treaty with India, financial reform programs, and downsizing of the role of government. Accordingly, Nepal made bilateral agreements with 18 countries. The majority of Free Trade Agreements (FTAs) of Nepal with trading partner countries are related to the merchandise trade rather than trade in services, investment, and labor mobility. SAARC member countries are more inclined towards bilateral free trade agreements (FTAs) to get easy access to the neighboring countries. Due to lack of common consensus to implement multilateral trade agreement, bilateral trade agreements are becoming more popular in SAARC member countries.

Likewise, on April 23, 2004, the country joined the World Trade Organization (WTO) as the 147th member. The basic notion for the open economic policy was to achieve economic development and growth by attracting domestic and foreign investment, generating employment opportunity and alleviating poverty. The process of opening the economy accelerated further after the restoration of democracy in 1990 by introducing new policies and amending existing policies in order to make them compatible with the outward oriented regime. Some of such policies are Industrial Policy 1992, Trade Policy 1992, Privatization Policy 1994.

Nepal has shown mixed economic performance during the period of study. Nepal's average GDP growth rate during the period of study (1990-2016) is recorded as 4.49%. Nepal's GDP growth stood at 4.64% in 1990 and reached a high at 8.21% in 1994 and low at 0.12% in 2002. Total export as a percentage of GDP stood at 10.53% in 1990; and reached a high of 26.33% in 1997; while the share of import in GDP was recorded 21.66% in 1990 and a high of 40.75% in 2016.

Nepal is known to have a comparative advantage in products like handmade woolen carpets, Pashmina products, readymade garments (RMG), leather and leather products, handicrafts, and gold and silver jewelry and in the tourism, hydroelectricity, and agro-processing industries. However, sandwiched between two large manufacturing powerhouses, India and China, Nepal faces huge disadvantages relating to the economy of scales. Nepal's comparative advantage in the production of goods is very slight, owing to its inadequate infrastructure and the appropriate technology required for their production.

Despite Nepal's economic reforms and active involvement in global trade, few studies have examined its trade pattern. One of the objectives of this study is to identify the pattern and flow of trade Nepal experiences with its major trading partners using a comprehensive dataset and a well-proven gravity model. The study uses the trade data of Nepal with its 26 major trading partner countries during the last 25 years. It uses the econometric model and is based on the explanatory variables which are economic size, exchange rate, trade - GDP ratio of the countries, distances and some controlling variables.

The paper is structured as follows. Section 2 include an overview of Nepal's trade relations and performance during the period 1990 t0 2016. Section 3 provides the literature review. Section 4 considers the empirical methods we explain our panel regression models, data, and the estimation methods. Section 5

presents and discusses the empirical results. The final section includes the conclusion.

2. NEPAL'S TRADE RELATIONS WITH KEY TRADING PARTNERS

Nepal signed first trade and transit treaty with India, the largest trade partner, in 1950, then after the treaty has been renewed several times and in March 2007, Nepal and India entered into bilateral trade treaty. After adopting liberalization policy since mid-1980's Nepal opened up the border for international trade and moved forward from inward-looking strategy to outward-looking strategy. As a result of an open economic policy, Nepal has entered into several bilateral, regional and multilateral trade agreements. Nepal is a member of two major regional trade agreements- South Asian Free Trade Area (SAFTA) since 2004 and Bay of Bengal Initiative for Multi-Sectoral Trade and Economic Co-operation (BIMSTEC) since 2004. Similarly, Nepal is the first least developed country (LDC) to become a member of World Trade Organization (WTO) in 2004 by negotiation. All these initiations indicate Nepal's move towards open economic policy and commitment towards international trade and global competition.

Table1: Trade shares (in percentage) of major trading partners over the period 1990-2016.

Countries	1990		2000		2010		2016	
	Export	Import	Export	Import	Export	Import	Export	Import
India	7.00	9.98	42.62	36.57	64.05	63.24	63.27	64.78
OECD (except Japan & USA)	60.67	28.60	25.06	17.54	14.31	7.07	14.75	4.58
USA	23.45	2.39	27.47	1.58	6.13	1.40	8.16	0.90
China	2.25	7.34	0.99	7.69	1.60	11.00	3.40	12.00
Japan	0.81	18.74	1.42	2.67	0.90	1.50	1.30	0.70
SAARC (except India)	0.89	1.46	0.93	0.78	9.01	0.38	3.94	0.52
ASEAN	3.01	22.18	0.37	12.84	0.59	6.60	1.41	5.63
Others	1.92	9.31	1.14	20.33	3.41	8.81	3.77	10.89
Total	100	100	100	100	100	100	100	100

Source: Direction of Trade Statistics (DOTS) Database (IMF).

Nepal's major trading partners include India, China, United States, Japan, Germany, and the ASEAN group. Table 1 presents the total contribution to Nepalese trade by the major trading partners over the period 1990-2016. The table shows that Organisation for Economic Co-operation and Developed (OECD) countries were the major export and import partners in 1990, accounting for 60.67% of the total exports value and 28.60% of the total value of imports. India accounted for more than 60% share of both Nepal's exports and imports, becoming the leading partner country in recent years. Exports to ASEAN countries became less significant. The proportion of import from China increased gradually in the recent years. The USA accounted for 23% of total exports in 1990, however, there are some fluctuations in it lately. The value of trade with SAARC (except India) was less than five percent of the total exports and imports during the period of study.

3. LITERATURE REVIEW

The gravity model is one of the most successful empirical approaches in trade. The gravity model was first applied to examine international trade flows by Tinbergen (1962). The earliest papers, Tinbergen (1962) and Poyhonen (1963), proposed the following gravity equation:

$$lnE_{ij} = \beta_0 + \beta_1 lnY_i + \beta_2 lnY_j + \beta_3 lnD_{ij} + \varepsilon_{ij} \qquad (1)$$

where the volume of bilateral exports between countries i and j (E_{ij}) depends on: Gross National Product (GNP) or market size of country i (Y_i); GNP or market size of the importing country j (Y_j); and the distance between the two countries, to proxy transportation cost of commodities from i to j (D_{ij}). The gravity model assumes that there is a positive relationship between the bilateral trade and the size of a trading partner. A country tends to trade more with a larger partner, holding all other

factors constant. The distance between partners is negatively linked to the bilateral trade.

Linnemann (1966) extended the above equation to bilateral trade and introduced population size of countries i and j (N_i and N_j) and the artificial trade resistance factor, (P_{ij}), to account for tariffs, quotas, and technical restrictions that limit trade. Linnemann's model took the following form:

$$lnX_{ij} = \beta_0 + \beta_1 lnY_i + \beta_2 lnY_j + \beta_3 lnD_{ij} + \beta_4 lnN_i + \beta_5 lnN_{ij} + \beta_6 lnP_{ij} + \varepsilon_{ij} \qquad (2)$$

The gravity equation is grounded in various international trade theories including the complete specialization models (Anderson (1979); Bergstrand (1985)); the Heckscher-Ohlin model (Bergstrand (1989); Deardorff (1995)); or the monopolistic competition model (Bergstrand (1989); Feenstra (2002)). The traditional gravity equations (1) and (2) have been applied extensively (McCallum (1995); Feenstra et al. (1998); Wolf (2000); Helliwell and Verdier (2001); Inmaculada and Lehmann (2002)). Frankel (1992) extends Eq. (2) further with the product form of GNP and the product form of per capita GNP as the proxies for country sizes and development stages, respectively. Over time, additional variables have been incorporated. For instance, Wall (1999) includes the trade policy index to measure the trade protection level of the US and her trading partners. Nguyen (2010) incorporates exchange rate, lagged trade volume, and regional trade preference for ASEAN to examine Vietnam's export flows.

Anderson and Wincoop (2003) argue that estimates of the above gravity models could be biased as these models ignore the multilateral resistance factors (MRFs) such as trade agreements, common language, common colonial base, remoteness, and adjacency (also see, Baier and Bergstrand (2009)). To quantify the impacts of MRFs on bilateral trade, Anderson and Wincoop (2003) asserted that these impacts need to be represented as part of the country specific effects in the

system using the fixed effect estimation method. Several authors use an alternative approach to capture these MRFs or country specific effects for a panel of trading partners (see, Zarzoso (2003); Zarzoso and Lehmann (2004); Bussiere, Fidrmuc, and Schnatz (2008); Fidrmuc (2009)). They take a two-step procedure, where the first step is to estimate bilateral trade volume against the time-variant gravity variables. The intercept is saved as the specific country-pair effects or individual country effects. The second step takes the saved specific effect series and regresses this against time constant MRFs (such as distance, language, remoteness, and adjacency). Interestingly, preferential trade agreements in these studies are treated as time variant variables.

Egger and Pfaffermayr (2003), in particular, notes that trade resistant factors such as membership to a multilateral agreement do not change over time and need to be captured in the country-pair specific effects or the intercept of the fixed effect estimation. Hence few recent authors take this approach to estimating the influence of trade agreements on bilateral trade (Antonucci and Manzocchi (2006) for Turkey against 45 trading partners and Bussiere and Schnatz (2009) for China against 61 trading partner countries).

4. DATA AND METHODOLOGY

4.1. ***Methodology***

In line with recent developments in the estimation of the panel gravity model, we begin with the following trade gravity model for Nepal, comprising only the time variant variables:

$$lnX_{ijt} = \beta_0 + \beta_1 \ln(Y_{it}Y_{jt}) + \beta_2 \ln(PY_{it}PY_{jt}) + \beta_3 \ln(DPY_{ijt}) + \beta_4 lnER_{ijt} + \beta_5 lnOpenness_{it} + \beta_6 lnOpenness_{jt} + \varepsilon_{ijt} \quad (3)$$

Here, X_{ijt} denotes Nepal's bilateral trade volume (which is the sum of bilateral exports and imports of goods) between Nepal

(country i) and a trading partner (country j) at time point t. $Y_{it}Y_{jt}$ is the income variable entering the equation as a product of Nepal's GDP and trading partner j at time t. Similarly, per capita income, $PY_{it}PY_{jt}$, is the product of per capita GDP for countries, i and j. Here DPY_{ijt} is the difference between Nepal's per capita income and country j's per capita income; and ER_{ijt} is the bilateral exchange rate between the two counties. All these variables appear as natural logs. The variables, $Openness_{it}$ and $Openness_{jt}$ denote the openness levels of Nepal and j trading partner, constructed as the total trade of goods as a ratio of GDP for each country at specific point time t. It is expected that the product of the GDP of Nepal and a trading partner would have a positive impact on bilateral trade flows as an increase in the scale of the two countries should encourage trade. Hence, β_1 is expected to be positive. The combined per capita income variable measures level of development within the bilateral relations, therefore, β_2 is expected to be positive. However, the volume of bilateral trade between the two countries may be disproportionately impacted if the trade barriers are high. Feenstra et al. (1998), for instance, argue that when the trade barriers on homogeneous goods from one supplying source are larger, the exports from this source could be restrained. The implication of the third income measure – that is, the difference between per capita incomes on bilateral trade – is ambiguous. β_3 is expected to be positive, if the bilateral trade relations are consistent with the H-O theory, with the implication that countries trade more if their factor endowment is different.

On the other hand, a negative for β_3 implies that Linder (1961) describes the nature of this trade flow, one where - the more two countries are similar, in terms of factor endowment, the more they might trade. The coefficient for bilateral exchange rate β_4 is expected to be positive. This suggests that an increase in the exchange rate, or a depreciation of the Rupee against trading partner currency, leads to an increase in bilateral trade flows between Nepal and the trading partner.

Finally, bilateral trade is likely to be enhanced when Nepal or her trading partners are more open to the world market, thus ß5 and ß6 are expected to be positive.

While one would suspect a certain degree of correlation among the regressors in Eq. (3), we find that it is worst between the income variables. Table 2 highlights the severity of the multicollinearity problem present in Eq. (3) for the income variables in the panels that we study. To avoid inaccurate estimation of the parameters, we break Model (3) into three different models in which the income variables appear separately in each and the remaining factors are consistent. The three different versions of Eq. (3) which are estimated as part of the first step are as follows:

$$lnX_{ijt} = \beta_0 + \beta_1 \ln(Y_{it}Y_{jt}) + \beta_4 lnER_{ijt} + \beta_5 lnOpenness_{it} + \beta_6 lnOpenness_{jt} + \varepsilon_{ijt} \quad (4)$$

$$lnX_{ijt} = \beta_0 + \beta_2 \ln(PY_{it}PY_{jt}) + \beta_4 lnER_{ijt} + \beta_5 lnOpenness_{it} + \beta_6 lnOpenness_{jt} + \varepsilon_{ijt} \quad (5)$$

$$lnX_{ijt} = \beta_0 + \beta_3 \ln(DPY_{ijt}) + \beta_4 lnER_{ijt} + \beta_5 lnOpenness_{it} + \beta_6 lnOpenness_{jt} + \varepsilon_{ijt} \quad (6)$$

The variables in Eqs. (4) – (6) follow from Eq. (3). We use the panel fixed effect estimation method to derive the parameters as well as the specific (or individual) effects for each panel studied. As noted above, these gravity equations for Nepal only comprise time-variant variables. In the second step, we capture the effects of time-invariant variables such as distance and multilateral trade agreements (dummies for WTO and SAARC). In the gravity estimations we follow closely the work of Egger and Pfaffermayr (2003) and the like to model the time constant variables on the individual (or special) effects:

$$SE = \beta_7 + \beta_8 lnDist_{ij} + \beta_9 D_{WTO} + \beta_{10} D_{SAARC} + \vartheta_{ijt} \quad (7)$$

Here, the SE or the specific effects are the cross-section effects drawn from estimating Eqs. (4) – (6) and $Dist_{ij}$ (in log form) represents the distance between the most important cities in Nepal and a trading partner country. For the multilateral trade agreements for WTO and SAARC, we developed binomial

variables which are respectively captured by D_{WTO} and D_{SAARC}. These two dummy variables take values of 1 if Nepal and a trading partner in the dataset belong to a multilateral agreement or take 0 if otherwise. The coefficient β_8 is expected to bear a negative sign as the distance between Nepal and trading partner proxies the cost of transporting goods. Coefficients, β_9 and β_{10} are expected to be positive, mainly because multilateral trade agreements are expected to induce a positive influence on trade between member countries.

Table 2: Correlation between income variables in the gravity model

	$\ln(Y_{it}Y_{jt})$	$\ln(PY_{it}PY_{jt})$	$\ln(DPY_{ijt})$
$\ln(Y_{it}Y_{jt})$	1		
$\ln(PY_{it}PY_{jt})$	0.5893	1	
$\ln(DPY_{ijt})$	0.4607	0.9507	1

This table presents the correlations between the three incomes variables used in the gravity model. $Y_{it}Y_{jt}$ is the income variable entering the equation as the product of GDP of Nepal(i) and trading partner (j) at time t. Similarly, $PY_{it}PY_{jt}$ is the product of per capita GDP of i and j. DPY_{ijt} is the difference between Nepal's per capita income and trading partner j's per capita income at time point t.

4.2. Data

Our study covers a total of 26 largest trading partner of Nepal. The countries are chosen on the basis of the importance of trading partnership with Nepal and the availability of required data. Annual data for the years 1990 to 2016 about Nepal and trading partners are collected from the following sources: the data relating to bilateral trade flows (exports with f.o.b. and imports with c.i.f. values) were taken from the Direction of Trade Statistics (DOTS) of the International Monetary Fund (IMF) and measured in US dollar millions at current prices. The World Development Indicator database was used for data

relating to GDP and per capita GDP (both in US dollar at current prices).

Data on exchange rates were taken from IMF in national currency per US dollar for all countries, hence the exchange rate between Nepal and partner countries are calculated through the US dollar. The data relating to distance were taken from the website https://www.searates.com/reference/portdistance/ to calculate shipping distances and from website http://www.distancefromto.net for air distance.

5. EMPIRICAL RESULTS

5.1. Overall Empirical Results

This study deals with four different sets of regression. Eq. (3) includes only time variant variables. The modeling procedure covered three income variables separately in Eqs. (4) - (6) since there is positive correlation between income variables. Eq. (7) incorporates only the time invariant trade resistance factors. We estimate models (4) - (7) to get an indication of the size and sign effects of the gravity variables for the all - country panel. We use the same panel to estimate Eqs. (3) and (7). Eq. (3), as stated above, includes all three income variables within one model - given high correlations between these variables, we suspect estimation results relating to this second model will be affected by the multicollinearity problem.

These gravity models are estimated by separating the income effect to address the multicollinearity issue. Next, we estimate the trade model with all the income variables together in the first step of the estimation procedure Eq. (3) – results relating to Eqs. (3) as well as (7) are displayed in Table 3. We observe that compared to coefficients in Eqs. (4) – (6), those of almost all independent variables are larger in size. A further level of development takes a negative sign, which is inconsistent with theory; exchange rate and distance (the proxy

for the cost of transportation) insignificant. We present the corresponding gravity coefficients in Table 3.

Table 3 displays the results for the all-country panel. The all-country results can be seen as the average effects of the whole set of countries income or regional effects. Table 3 shows that variables $Openness_{it}$ (trade-GDP ratio of Nepal) and $Openness_{jt}$ (trade-GDP ratio of partner countries) are significant. Further, notice that the all country results suggest that the variable WTO (D_{WTO}) and SAARC (D_{SAARC}) are inconsistent with model; and D_{WTO} is insignificant (in panel 1 and 4).

Table 3: Results of the trade gravity model

Independent Variables	Panel 1 Coefficient	Panel 2 Coefficient	Panel 3 Coefficient	Panel 4 Coefficient
	Eqs. (4) & (7)	Eqs. (5) & (7)	Eqs. (6) & (7)	Eqs. (3) & (7)
Constant	-4.108**	9.241***	7.353***	-19.239**
	(1.662)	(0.540)	(0.625)	(9.517)
$\ln(Y_{it}Y_{jt})$	0.421***			0.833***
	(0.036)			(0.297)
$\ln(PY_{it}PY_{jt})$		0.487***		-1.003***
		(0.042)		(0.376)
$\ln(DPY_{ijt})$			0.989***	1.070***
			(0.077)	(0.183)
$\ln ER_{ijt}$	0.093***	0.095**	0.079***	0.074***
	(0.025)	(0.025)	(0.024)	(0.025)
$Openness_{it}$	0.712	1.095*	0.748	-0.046
	(0.576)	(0.0007)	(0.552)	(0.619)
$Openness_{jt}$	0.104	-0.023	0.256	0.119
	(0.189)	(0.187)	(0.178)	(0.194)
$\ln Dist_{ij}$	-1.441***	-1.609***	-1.975***	-1.673***
	(0.082)	(0.096)	(0.114)	(0.068)
D_{WTO}	-0.145	-0.212**	-0.215*	-0.083
	(0.097)	(0.107)	(0.114)	(0.090)
D_{SAARC}		-1.408***	0.494*	-0.602***
	-2.042***	(0.218)	(0.273)	(0.167)
	(0.179)			

Note: Coefficients with *, **, and *** are statistically significant at the 10%, 5%, and 1% level, respectively.

5.2. Simulation: Predicted Vs. Actual

Eagger (2002) has explained in his paper that the gravity model is effective for simulation analysis. Sohn (2005) has used this method to analyze South Korea's trade pattern. In Sohn's paper, it is shown that the difference between actual and predicted trade volume can be understood as an "unexhausted"

trade potential. Table 4 presents the predicted trade volume of Nepal with its major trading partners. The result in table 4 is derived from the results of gravity equations (3) and (7).

Table 4: Simulation of Nepal's Trade with Different Regions

Countries	Actual Trade (%)	Estimated Trade (%)
India	50.41	60.90
China	18.51	19.91
OECD (except Japan &USA)	11.31	5.93
USA	5.62	2.08
Japan	1.99	4.36
SAARC (except India)	1.21	2.95
ASEAN	4.14	2.62
Others	6.81	1.25
Total	100	100

Source: Author's Calculation

The table 4 shows that the actual trade between Nepal-India, Nepal-China and Nepal-Japan is less than the predicted trade volume. However India is large trading partner of Nepal, so there is a need of trade diversification for Nepal as China and Japan seems to be potential trading partner. Similarly, Nepal's actual trade with SAARC countries is also lower than the predicted values.

6. CONCLUSION

This paper is based on an empirical examination of Nepal's pattern of international trade. The study uses the gravity model for the period from 1990 to 2016. The empirical results are basically consistent with the predictions of the gravity model, and the coefficients for most of the variables are as expected, with some exceptions, such as a negative sign for $Openness_{it}$ in Eq. (3); negative sign for $Openness_{jt}$ in Eq. (2); and negative sign for WTO and SAARC. The product of GDP, which is the proxy for the economic size of the trading partner countries, was found to positively affect bilateral trade with Nepal. The negative sign of per capita GDP in Eq. (3) shows that Nepal exports labor-intensive goods and imports necessity goods. The

positive and significant coefficient of Linder shows that Nepal's trade is determined by comparative advantages with different economies. Therefore, inter industry trade is common and goods are imported to and exported from developed countries. Nepal's trade with SAARC countries is significant but inconsistent with the model. Moreover, no evidence was found to indicate that Nepal benefits from the WTO for its exports and imports. The distance coefficient shows that Nepal's imports are concentrated with its nearer trading partners.

The result from simulation shows that the Nepal's trade is highly concentrated with India, hence it suggests that Nepal should redirect its trading activities to China to reduce excessive and risky dependence trade on India. Since China is bordering country with high and consistent economic growth over the last several years, Nepal could acquire a large international market for its exports by improving the trade relations.

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